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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] The function of a urinary system applies this invention to the patient etc. who fell, and it relates to the urination alarm equipment with an irradiation-angles auto select function of a suitable ultrasonic wave.

[0002]

[Description of the Prior Art] Moisture in the living body is adjusted so that many functions may be kept pure, but superfluous moisture is stored within a bladder via a ureter from the kidney, and if it reaches a urination level, it will be discharged by uresiesthesia as urine with unnecessary metabolite to the outside of the body.

[0003] If there are abnormalities in damage to the autonomic nerve which governs the bladder of this discharge mechanism, an optional nerve, and a mechanism of micturition, etc. or a urination function falls, the uresiesthesia which is a natural physiological reaction will lose and it will become easy to produce urinary incontinence.

[0004] The aging in our country is progressing remarkably in recent years, it is in the tendency which the patient to whom the function of the urinary system fell increases, and 5 million people and 6 million people of the patient number are presumed now. Also in the patient who fell, a urination function is increasing by the automobile accident, the operation in a pelvis, etc. also except elderly people. Although urinary incontinence is not the illness concerning a life, maintenance of comfortable everyday life is difficult.

[0005] Since going out becomes cowardly in the case of a urinary incontinence person and it can become difficult to perform working and intervention to work, a travel, a sport, other recreations, etc., these become a cause, dissatisfaction and stress are induced and positive everyday life and social activity are checked remarkably in many cases.

[0006] Existing barely as a means for preventing such urinary incontinence positively now has a urination sensor which detects a patient's urinary incontinence using a moisture mind sensor and about which a patient and a care worker are told, a urination pacemaker which makes it urinate compulsorily with a certain time interval irrespective of a patient's intention, etc.

[0007] Even if it sees these apparatus from the point of the dignified and natural physiological reaction as human being, there are many problems -- the intervention to release from a diaper, positive everyday life, and a social activity -- it should also wish -- there is nothing.

[0008]Although the ultrasonic diagnostic equipment which measures the urine volume in a bladder may be installed in facilities, such as a hospital, since this is made as an institution in a hospital and it is expensive and large-sized, the patient cannot be carrying it easily as an object for patients.

[0009]

[Problem(s) to be Solved by the Invention]Thus, although the device which can detect a patient's urinary incontinence condition is made, the device which can work without equipping a patient and caring the outside of indoor about urinary incontinence freely is still in a developmental stage.

[0010]From such a thing, the measuring means in which the cellular phone for urinary incontinence prevention is possible is used, It is non-invasive, it is stabilized simply and the measurement detection of the urine volume in a bladder having reached the urination level can be carried out, and in order to send the same everyday life and social activity as a healthy person with a normal physiological function, development of the alarm equipment for urination care devices assisted and supported has a very important meaning.

[0011]Although a bladder is an organ which is rich in elasticity, uniform elasticity is not carried out in all the directions like a balloon. The front face of a bladder and the undersurface have adhered to the circumference by adventitia, and only the Gokami side covered with the peritoneum carries out the unique shape change depending on combination with taking up and down and a circumference organization. Therefore, individual difference is remarkable. Unless it also takes this individual difference into consideration enough in detecting a urination level, the urination information stable to all the patients putting on a device is unrealizable.

[0012]Then, this invention solves such a conventional technical problem, is noninvasively stabilized in a small light weight, embrace a patient's individual difference, and enable it to detect and report a urination level, and. The urination alarm equipment with an ultrasonic irradiation angle auto select function which enabled it to choose the optimal irradiation angles of an ultrasonic wave automatically according to a patient's individual difference is proposed.

[0013]

[Means for Solving the Problem]In [in order to solve an above-mentioned technical problem] this invention, Drive an ultrasonic probe with which an ultrasonic wave is irradiated for a patient's urine volume detection, and this ultrasonic probe, and receive an ultrasonic reflection echo corresponding to a front wall and a posterior wall of stomach of a bladder, and. It comprises an ultrasonic transmitter-receiver which judges whether reservoir urine volume is a urination level, and an alarm emitted to a patient or a care worker when reservoir urine volume is judged to be a thing exceeding a urination level, Several vibrators from which irradiation angles differ are stored by the above-mentioned ultrasonic probe, Excitation pulses were supplied to a vibrator of these plurality one by one in time sharing, and it was made as [use / a vibrator of an ultrasonic irradiation angle from which a level of an ultrasonic reflection echo / near a urination level / serves as the maximum / as a vibrator for urination measurement].

[0014]

[Function]As shown in drawing 1, with the ultrasonic probe 20 with which it equipped on the skin side 1 of the joint upper part of the pubis 2 of the hypogastrium, the bladder 3 in the living body is irradiated with an ultrasonic wave, the ultrasonic transmitter-receiver 40 detects the reflective echo (received wave) of the ultrasonic

wave, and the front wall surface of the bladder 3 and the posterior-wall-of-stomach face-to-face distance W are measured. The urine volume in a bladder can be presumed with this distance W, and when the urination level which it set up beforehand is reached, the alarm 50 operates and it reports to a patient or a care worker. A buzzer, a telltale light, a sensing pin, etc. can be considered as the alarm 50.

[0015]The irradiation angles theta to the optimal reflection region in a bladder of the ultrasonic probe 20 which a patient's posture fixes to the skin side 1 under conditions with body motions, such as a standing position, a seating position, and decubitus, are adjusted to an optimal position. An optimal position corresponds to the position (the angle theta from the base line p with the degree of reference angle of 0 degree) from which the level of a reflective echo serves as the maximum.

[0016]As shown in drawing 5, before arranging the ultrasonic vibrators 21a-21d which are four to which irradiation angles are different in the ultrasonic probe 20 and using alarm equipment, an ultrasonic vibrator selection process is performed for using which vibrator the land survey of the urination level is carried out.

[0017]Therefore, excitation pulses are supplied to the vibrators 21a-21d of these plurality one by one in time sharing, and the vibrator of the ultrasonic irradiation angle from which the level of an ultrasonic reflection echo [near a urination level] serves as the maximum is used as a vibrator for urination measurement.

[0018]Since it is not based on a patient's individual difference, but it is stabilized and a urination level can be correctly detected by forming the auto select means of an ultrasonic irradiation angle, a suitable alarm can be taken out.

[0019]

[Example]Then, an example of the urine volume alarm equipment with an angle adjustment function concerning this invention is explained in detail with reference to drawings.

[0020]In this invention, in the living body is gone straight on, the character of the ultrasonic wave reflected from the interface of an organization is applied, an ultrasonic probe is fixed to a hypogastrium body surface (upper part of pubic symphysis), the reflective echo from the front wall and posterior wall of stomach of a bladder is measured temporally, and the urine volume in a bladder is presumed with that distance.

[0021]***** [that reservoir urine volume has reached the urination level by carrying out the automatic meter reading of the urine volume stored in the bladder by this by non-invasion] -- non-invasion -- and it is continuously and automatically measurable.

[0022]Therefore, the ultrasonic probe 20 with which an ultrasonic wave is irradiated for a patient's urine volume detection as the urination alarm equipment 10 concerning this invention is shown in drawing 1 A, Drive this ultrasonic probe 20, and receive the ultrasonic reflection echo corresponding to the front wall and posterior wall of stomach of the bladder 3, and. It comprises the ultrasonic transmitter-receiver 40 which judges whether reservoir urine volume is a urination level, and the alarm 50 emitted to a patient or a care worker when reservoir urine volume is judged to be a thing exceeding a urination level.

[0023]As the example is shown in drawing 1, the urine volume stored condition in a bladder changes from drawing 1 A which shows the state immediately after urination, as shown in the Drawing C showing the state where it seems that the urination level was reached. Drawing 2 shows the relation of the ultrasonic pulse (it is the excitation pulses to a vibrator and the frequency is 3-4 MHz) and reflective echo (received

wave) which are irradiated by in the living body. In [drawing 1](#), 4 is a ureter and 5 is reservoir urine.

[0024]The direction of radiation of an ultrasonic wave is as the dashed line having shown to [drawing 1](#), and the reflective echo when based on these irradiation angles theta is shown in [drawing 2](#). [Drawing 2 B](#) is a reflective echo at the time of the stored condition near [drawing 1 B](#), and the [Drawing D](#) shows the reflective echo at the time of the stored condition near [drawing 1 C](#).

[0025]Since it is near the urination level with which a patient holds uresiesthesia, in the case of [drawing 1](#), that it must detect most correctly among these reflective echoes must be able to detect most correctly the ultrasonic reflection echo at the time of the [Drawing C](#) ([drawing 2 D](#)). Since the reservoir urine volume which holds uresiesthesia has individual difference, it is necessary to measure beforehand the urination level which holds uresiesthesia for every patient.

[0026]Since the shape of the bladder 3 has individual difference and it changes also with a patient's postures, in order to avoid the influence on the measurement accuracy by these individual difference, the irradiation angles theta of an ultrasonic wave are adjusted for every patient who uses the alarm equipment 10 so that it may become the optimal reflection region in a bladder, as shown in [drawing 3](#).

[0027]The line p which becomes vertical [the ultrasonic irradiation angle of the ultrasonic vibrator 21 in the living body] to the skin side 1 in the time of applying the ultrasonic probe 20 to the skin side 1 turns into a base line, and the irradiation angles theta are taken toward the direction of the bladder 3 from this base line p.

[0028]Measurement of the ease (detected strength of a reflective echo) of detecting of the reflective echo when changing the irradiation angles theta at a 10-degree step obtained a result like [drawing 4](#). This figure is a detection result at the time of the state of [drawing 1 C](#).

[0029]It is better to adjust preferably 30 degrees of irradiation angles theta of the ultrasonic vibrator 21 within the limits of 10 to 20 degrees from 10 degrees so that clearly also from [drawing 4](#). However, it cannot be overemphasized that there is individual difference in this value.

[0030]Then, even if there is individual difference, in order to be always able to detect a urination level correctly, As shown in [drawing 5](#), the ultrasonic vibrators 21a-21d which are the plurality, for example, four pieces, to which irradiation angles are different from the ultrasonic probe 20, respectively are stored in the probe body 31, and a actual urination level is measured with one ultrasonic vibrator with the irradiation angles suitable for the patient who equips.

[0031][Drawing 5](#) is an example which has arranged the four ultrasonic vibrators 21a-21d in the shape of in-line one, and that from which 10 degrees of irradiation angles theta to the irradiation position which serves as a target as each is shown in [drawing 6](#) shifted at a time is used. In [drawing 6](#), q is the direction of ultrasonic irradiation.

[0032]The irradiation angles theta are examples, and they may use the ultrasonic vibrator selected so that irradiation angles might be 0 degree, 10 degrees, 20 degrees, and 30 degrees, for example rather than may use the ultrasonic vibrators 21a-21d in which irradiation angles will be 10 degrees, 20 degrees, 30 degrees, and 40 degrees to the standard direction of radiation p like [drawing 6](#). Irradiation angles may use an ultrasonic vibrator with the irradiation angles of the arbitrary steps instead of a 10-degree step. The use number is also arbitrary.

[0033][Drawing 7](#) is drawing of longitudinal section which contains the ultrasonic vibrator 21a, in the probe body 31, it is hollow and the vibrator storage housing 35 is

fixed to the main part 31 in it. And the irradiation angles θ of the ultrasonic vibrator 21a are attached in the state where it was adjusted so that it might become 10 degrees to the base line p. The ultrasonic vibrator 21a side is sealed by the films 32, such as rubber, so that the jelly 33 may be filled up with this example that is all a deaeration agent of an ultrasonic wave in the main part 31 and the housing 35 and the jelly 33 with which it filled up may not leak. 34 is an attaching means for attaching a film.

[0034]The housing 35 is a rectangular parallelepiped and installation fixing also of the other ultrasonic vibrators 21b-21d is carried out here with predetermined irradiation angles, respectively. In that case, the ** system of mutual may be carried out with a diaphragm etc. between the ultrasonic vibrators 21a-21d. The housing which stores these for every ultrasonic vibrator may be provided.

[0035]Drawing 8 is a case where it arranges the ultrasonic vibrators 21a-21d at a time to two rows [two], an ultrasonic vibrators [in this case / 21a-21d] locating position is arbitrary, and it is not restricted to the example of drawing 8.

[0036]As shown in drawing 1, since the bladder 3 is located after pubis 2 combination in a pelvis, it needs to carry out installation fixing of the ultrasonic probe 20 correctly on the median line of pubic symphysis right above on a body surface skin side.

[0037]Therefore, the small flat ultrasonic probe 20 is attached in the brace for fixation 11 of the shape of a band which consists of elastic materials as shown in drawing 9. Since the composition which attached only the ultrasonic probe 20 to the brace for fixation 11 by a diagram is shown, the ultrasonic transmitter-receiver 40 and the alarm 50 are attached to somewhere else of this brace for fixation 11, or a patient's belt etc. are equipped with them. It is also possible to unify the ultrasonic probe 20, the ultrasonic transmitter-receiver 40, and the alarm 50.

[0038]It is equipped with the brace for fixation 11 on a predetermined body surface skin side (upper part of pubic symphysis). the brace for fixation 11 can use a lumbar band (corset) etc. -- the part -- ***** -- installation fixing of the ultrasonic probe 20 is carried out to him and its portion. When equipping, the jelly for ultrasonic measurement as a deaeration agent is applied to the surface of the ultrasonic probe 20.

[0039]Now, to actually use the ultrasonic probe 20 which stored two or more ultrasonic vibrators in this way, it is necessary to find the irradiation angles which suited the patient who uses it as the preparatory step, and to measure a urination level with an ultrasonic vibrator with the irradiation angles. Therefore, such an irradiation-angles auto select function is added to the ultrasonic transmitter-receiver 40 used by this invention.

[0040]Drawing 10 shows an example of the ultrasonic transmitter-receiver 40 used in this invention. If the signal whose frequency is 3 MHz is given to the ultrasonic vibrator 21 in this example from the transmission section 41, this will be excited and a 2.27mV (average value)/square centimeter ultrasonic pulse will be irradiated towards the body surface skin side 1 in irradiation power.

[0041]By the exposure of this ultrasonic wave, a body surface skin side echo, the anterior wall echo of the bladder 3, and the reflective echo (the skin side echo is omitted in refer to drawing 2 and drawing 2) that consists of a posterior-wall-of-stomach echo are obtained. Reception amplification is carried out by the receiving amplifier 42, and this is changed into a digital signal with A/D converter 43 after that. The reflective echo was changed into the digital signal in order to raise the detecting accuracy of the urination level mentioned later.

[0042]An anterior wall echo and a posterior-wall-of-stomach echo as shown [figure 2](#) with the echo detection machine 44 are detected correctly, and the reflective echo of these ultrasonic waves is supplied to the urine volume measurement means 45 after that. The measurement means 46 which measures the time interval of a reflective echo is formed in the urine volume measurement means 45, based on the time interval obtained from this, the distance W between front [its] and posterior wall of stomach is computed, and the urine volume in a bladder is presumed. It is distinguished from the preset value of the urination level which the estimate (in practice point estimate) set up beforehand in the discriminating means 47.

[0043]when it was judged that it is over the urination level as a result, the alarm 50 operated, and the urine volume in a bladder reached the urination level -- a patient -- it is reported to the person himself/herself or a care worker.

[0044]an alarming means visual as an alarming means, auditory, and tactile can be considered -- a patient -- if it can report that it is a urination stage certainly to the person himself/herself or a care worker, the combination of an alarming means is arbitrary.

[0045]In [drawing 10](#), 48 is a controller of microcomputer loading and, as for all, setting out of the reference value according to calculation and the individual difference of the output clock for the transmit timing and A/D conversion processing which were mentioned above, echo detection processing work, and the distance W is performed by the instructions from this controller 48. Therefore, each of urine volume measurement means 45, echo detection means 44, etc. can be processed by software.

[0046]There is no necessity in particular of monitoring the stored condition in a bladder continuously. It is because it is not necessary to observe temporally in particular in between until just before it approaches the urination level which holds uresiesthesia from immediately after urination. Therefore, immediately after urination to fixed time can also add a timer function which stops the exposure of an ultrasonic wave and stops measurement processing temporarily. It is because the life whose this gentleman is a power supply is extended and it is economical.

[0047]Since the depth from the body surface of the posterior-wall-of-stomach side of the bladder 3 may exceed about 11 cm at the time of urine fullness, it is necessary to design ultrasonic irradiation frequency and irradiation power it be measurable enough also with such depth.

[0048]The control program for realizing the irradiation-angles auto select function of an ultrasonic wave exists in the controller 48 mentioned above. Therefore, at the time of irradiation-angles auto select processing, as shown in [drawing 10](#), the vibrator switch circuit 39 established in the ultrasonic transmitter-receiver 40 operates, and the ultrasonic signal from the transmission section 41 is transmitted to the ultrasonic vibrators 21a-21d one by one in time sharing in the given order. The vibrator switch circuit 39 is controlled by a command signal from the controller 48. Since the reflective echo of an ultrasonic wave is supplied to common reception and the amplifier 42, the means for switching is unnecessary.

[0049][Drawing 11](#) is an example of the processing flow chart for determining automatically the ultrasonic vibrator which a patient uses.

[0050]The time of a reservoir urine state with the patient near a urination level who should carry this alarm equipment 10 as that premise is chosen at its own discretion, and a decision of a use vibrator is made. First, the vibrator which should be excited first is chosen (Step 51). In this example, it shall be chosen sequentially from 21a. If

a vibrator is chosen, excitation pulses will be impressed to the vibrator and this will be excited (Step 52).

[0051]The echo reflected by the bladder 3 is changed into an after-reception digital signal, waveform processing of smoothing processing etc. is performed after that, and the memory of the receiving level of a reflective echo is carried out simultaneously (Steps 53, 54, and 55).

[0052]Such processing is performed until the last ultrasonic vibrator 21d is excited, If the reflective echo of the last ultrasonic vibrator 21d is received and the level is stored in a memory (Step 56), processing which distinguishes the greatest receiving level among four receiving levels will be performed, and, next, the ultrasonic vibrator in which the greatest receiving level was obtained will be become final and conclusive (Steps 57 and 58). Since this ultrasonic vibrator is used as a actual object for urination measurement, the switching position of the vibrator switch circuit 39 is fixed so that an ultrasonic pulse may always be supplied to the ultrasonic vibrator used as the greatest receiving level.

[0053]After determining the ultrasonic vibrator to be used, that decision result displays on the display for indication 38 if needed (Step 59), and this process flow is completed.

[0054]Even if there is individual difference by performing the above auto select processings, a urination level can be measured with the optimal irradiation angles suitable for the patient who should carry alarm equipment. Auto select processing may be performed every several months.

[0055]

[Effect of the Invention]According to the urination alarm equipment of this invention, so that clearly from the place explained in full detail above. ***** [that the urine volume stored in the bladder by adopting small size and a lightweight and portable measuring means has reached the urination level] -- non-invasion -- and -- carrying out an automatic meter reading simple -- a patient -- the person himself/herself can also inform the care worker of the time which holds uresilesthesia correctly having come from the first.

[0056]Although the shape at the time of urine fullness of a bladder has individual difference, in order have adjusted the irradiation angles of the ultrasonic vibrator automatically so that it can be adapted also for this individual difference, even if it is what kind of patient -- that patient -- the urination level of the person himself/herself can be exactly judged now, and the comfortable life without fear of urinary incontinence can be led now.

[0057]Since selection of the optimal irradiation angles of an ultrasonic wave is performed automatically and selection of an ultrasonic vibrator can also be performed automatically, always good measurement and alarm processing are realizable.

CLAIMS

[Claim(s)]

[Claim 1]Drive an ultrasonic probe with which an ultrasonic wave is irradiated for a patient's urine volume detection, and this ultrasonic probe, and receive an ultrasonic reflection echo corresponding to a front wall and a posterior wall of stomach of a bladder, and. It comprises an ultrasonic transmitter-receiver which judges whether reservoir urine volume is a urination level, and an alarm emitted to a patient or a care

worker when reservoir urine volume is judged to be a thing exceeding a urination level, Several vibrators from which irradiation angles differ are stored by the above-mentioned ultrasonic probe, Urination alarm equipment with an irradiation-angles auto select function making as [use / a vibrator of an ultrasonic irradiation angle from which excitation pulses are supplied to a vibrator of these plurality one by one in time sharing, and a level of an ultrasonic reflection echo / near a urination level / serves as the maximum / as a vibrator for urination measurement].

[Claim 2]The urination alarm equipment with an irradiation-angles auto select function according to claim 1, wherein an ultrasonic irradiation angle is made as [differ / a 10 degree step every].

[Claim 3]The urination alarm equipment with an irradiation-angles auto select function according to claim 1 constituting combining which an alarming means visual [the above-mentioned alarm], auditory, and tactile or them.

[Translation done.]